

WHAT IS CLAIMED IS:

1. A manufacturing method of a D/A converter circuit, comprising the steps of:
 - forming a resistor string which includes a plurality of resistors connected in series between reference voltages;
- 5 forming a plurality of switching elements, each of the plurality of switching elements being connected with a connection node of corresponding one of the plurality of resistors;
- disposing all forming parts of the resistors configuring the resistor string within a laser irradiation area; and
- 10 crystallizing all the forming parts of the resistors which are disposed within the laser irradiation area with a same laser shot,
 - wherein each of the resistors is a thin film element crystallized by linear laser irradiation.
2. The manufacturing method of a D/A converter circuit according to claim 1, wherein each forming part of the resistors is disposed to be parallel with each other, and also to be parallel with a scan direction of the linear laser irradiation.
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3. The manufacturing method of a D/A converter circuit according to claim 1, wherein each forming part of the resistors is all formed to have a same shape.
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4. A manufacturing method of a D/A converter circuit, comprising the steps of:
 - forming a resistor string which includes a plurality of resistor groups connected in series between reference voltages;
 - forming a plurality of resistors which are connected in series to configure each of the resistor groups;
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- forming a plurality of switching elements, each of the plurality of switching elements being connected with a connection node of corresponding one of the plurality of resistors;
- disposing forming parts of the series-connected resistors of each resistor group within each different laser irradiation area;
- crystallizing all the forming parts of the resistors which are disposed within the laser
- 30
- irradiation area with a same laser shot; and

disposing auxiliary resistors so as to be connected in parallel with each resistor group,
wherein each of the resistors is a thin film element crystallized by linear laser irradiation;
wherein each of the auxiliary resistors has a same resistance value that is sufficiently
smaller than a combined resistance value of the resistor group to which each auxiliary resistor is
5 connected.

10 5. The manufacturing method of a D/A converter circuit according to claim 4, wherein:
each of the auxiliary resistors is a thin film element crystallized by laser irradiation;
all forming parts of the auxiliary resistors are disposed within a laser irradiation area; and
all the forming parts of the auxiliary resistors which are disposed within the laser
irradiation area are crystallized with a same laser shot.

15 6. The manufacturing method of a D/A converter circuit according to claim 4, wherein
each forming part of the resistors is disposed to be parallel with each other, and also to be
parallel with a scan direction of the linear laser irradiation.

7. The manufacturing method of a D/A converter circuit according to claim 4, wherein
each forming part of the resistors is all formed to have a same shape.

20 8. A manufacturing method of a D/A converter circuit, comprising the steps of:
forming a resistor string which includes a plurality of resistors connected in series
between reference voltages;
forming a plurality of switching elements, each of the plurality of switching elements
being connected with a connection node of corresponding one of the plurality of resistors;
25 disposing all forming parts of the resistors configuring the resistor string within a laser
irradiation area; and
crystallizing all the forming parts of the resistors which are disposed within the laser
irradiation area with one laser shot,
wherein each of the resistors is a thin film element crystallized by linear laser irradiation.

9. The manufacturing method of a D/A converter circuit according to claim 8, wherein each forming part of the resistors is disposed to be parallel with each other.

10. The manufacturing method of a D/A converter circuit according to claim 8, wherein
5 each forming part of the resistors is all formed to have a same shape.

11. A manufacturing method of a D/A converter circuit, comprising the steps of:
forming a resistor string which includes a plurality of resistor groups connected in series between reference voltages;

10 forming a plurality of resistors which are connected in series to configure each of the resistor groups;

forming a plurality of switching elements, each of the plurality of switching elements being connected with a connection node of corresponding one of the plurality of resistors;

15 disposing forming parts of the series-connected resistors of each resistor group within each different laser irradiation area;

crystallizing all the forming parts of the resistors which are disposed within the laser irradiation area with one laser shot;

disposing auxiliary resistors so as to be connected in parallel with each resistor group,

wherein each of the resistors is a thin film element crystallized by linear laser irradiation;

20 wherein each of the auxiliary resistors has a same resistance value that is sufficiently smaller than a combined resistance value of the resistor group to which each auxiliary resistor is connected.

12. The manufacturing method of a D/A converter circuit according to claim 11, wherein:

25 each of the auxiliary resistors is a thin film element crystallized by laser irradiation;

all forming parts of the auxiliary resistors are disposed within a laser irradiation area; and

all the forming parts of the auxiliary resistors which are disposed within the laser irradiation area are crystallized with one laser shot.

30 13. The manufacturing method of a D/A converter circuit according to claim 11, wherein

each forming part of the resistors is disposed to be parallel with each other.

14. The manufacturing method of a D/A converter circuit according to claim 11, wherein each forming part of the resistors is all formed to have a same shape.

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15. A manufacturing method of a semiconductor device incorporating a D/A converter circuit, comprising the steps of:

forming a resistor string which includes a plurality of resistors connected in series between reference voltages;

10 forming a plurality of switching elements, each of the plurality of switching elements being connected with a connection node of corresponding one of the plurality of resistors;

disposing all forming parts of the resistors configuring the resistor string within a laser irradiation area; and

15 crystallizing all the forming parts of the resistors which are disposed within the laser irradiation area with a same laser shot.

wherein each of the resistors is a thin film element crystallized by linear laser irradiation;

16. The manufacturing method of a semiconductor device incorporating a D/A converter circuit according to claim 15, wherein each forming part of the resistors is disposed to be parallel 20 with each other, and also to be parallel with a scan direction of the linear laser irradiation.

17. The manufacturing method of a semiconductor device incorporating a D/A converter circuit according to claim 15, wherein each forming part of the resistors is all formed to have a same shape.

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18. A manufacturing method of a semiconductor device incorporating a D/A converter circuit, comprising the steps of:

forming a resistor string which includes a plurality of resistor groups connected in series between reference voltages;

30 forming a plurality of resistors so as to be connected in series to configure each of the

resistor groups;

forming a plurality of switching elements, each of the plurality of switching elements being connected with a connection node of corresponding one of the plurality of resistors;

disposing forming parts of the series-connected resistors of each resistor group within 5 each different laser irradiation area;

crystallizing all the forming parts of the resistors which are disposed within the laser irradiation area with a same laser shot; and

disposing auxiliary resistors so as to be connected in parallel with each resistor group,

wherein each of the resistors is a thin film element crystallized by linear laser irradiation;

10 wherein each of the auxiliary resistors has a same resistance value that is sufficiently smaller than a combined resistance value of the resistor group to which each auxiliary resistor is connected.

19. The manufacturing method of a semiconductor device incorporating a D/A converter 15 circuit according to claim 18, wherein:

each of the auxiliary resistors is a thin film element crystallized by laser irradiation;

all forming parts of the auxiliary resistors are disposed within a laser irradiation area; and

all the forming parts of the auxiliary resistors which are disposed within the laser irradiation area are crystallized with a same laser shot.

20 20. The manufacturing method of a semiconductor device incorporating a D/A converter circuit according to claim 18, wherein each forming part of the resistors is disposed to be parallel with each other, and also to be parallel with a scan direction of the linear laser irradiation.

25 21. The manufacturing method of a semiconductor device incorporating a D/A converter circuit according to claim 18, wherein each forming part of the resistors is all formed to have a same shape.

30 22. A manufacturing method of a semiconductor device incorporating a D/A converter circuit, comprising the steps of:

- forming a resistor string which includes a plurality of resistors connected in series between reference voltages;
- forming a plurality of switching elements, each of the plurality of switching elements being connected with a connection node of corresponding one of the plurality of resistors;
- 5 disposing all forming parts of the resistors configuring the resistor string within a laser irradiation area; and
- crystallizing all the forming parts of the resistors which are disposed within the laser irradiation area with one laser shot.
- wherein each of the resistors is a thin film element crystallized by linear laser irradiation;
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23. The manufacturing method of a semiconductor device incorporating a D/A converter circuit according to claim 22, wherein each forming part of the resistors is disposed to be parallel with each other.
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24. The manufacturing method of a semiconductor device incorporating a D/A converter circuit according to claim 22, wherein each forming part of the resistors is all formed to have a same shape.
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25. A manufacturing method of a semiconductor device incorporating a D/A converter circuit, comprising the steps of:
- forming a resistor string which includes a plurality of resistor groups connected in series between reference voltages;
- forming a plurality of switching elements, each of the plurality of switching elements being connected with a connection node of corresponding one of the plurality of resistors;
- 25 disposing forming parts of the series-connected resistors of each resistor group within each different laser irradiation area;
- crystallizing all the forming parts of the resistors which are disposed within the laser irradiation area with one laser shot; and
- disposing auxiliary resistors so as to be connected in parallel with each resistor group,
- 30 wherein each of the resistors is a thin film element crystallized by linear laser irradiation;

wherein each of the auxiliary resistors has a same resistance value that is sufficiently smaller than a combined resistance value of the resistor group to which each auxiliary resistor is connected.

5 26. The manufacturing method of a semiconductor device incorporating a D/A converter circuit according to claim 25, wherein:

each of the auxiliary resistors is a thin film element crystallized by laser irradiation;

all forming parts of the auxiliary resistors are disposed within a laser irradiation area; and

all the forming parts of the auxiliary resistors which are disposed within the laser

10 irradiation area are crystallized with one laser shot.

27. The manufacturing method of a semiconductor device incorporating a D/A converter circuit according to claim 25, wherein each forming part of the resistors is disposed to be parallel with each other.

15 28. The manufacturing method of a semiconductor device incorporating a D/A converter circuit according to claim 25, wherein each forming part of the resistors is all formed to have a same shape.

20 29. A D/A converter circuit comprising:

a resistor string which includes a plurality of resistors connected in series between reference voltages; and

a plurality of switching elements, each of the plurality of switching elements being connected with a connection node of corresponding one of the plurality of resistors,

25 wherein:

each of the resistors is a thin film element crystallized by linear laser irradiation;

all forming parts of the resistors configuring the resistor string are disposed within a laser irradiation area; and

30 all the forming parts of the resistors which are disposed within the laser irradiation area are irradiated with a same laser shot.

30. The D/A converter circuit according to claim 29, wherein each forming part of the resistors is disposed to be parallel with each other, and also to be parallel to a scan direction of the linear laser irradiation.

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31. The D/A converter circuit according to claim 29, wherein each forming part of the resistors has a same shape.

32. The D/A converter circuit according to claim 29, wherein each forming part of the resistors is connected with each other by a metal wiring having a same resistance value as those of the resistors.

33. A D/A converter circuit comprising:
a resistor string which includes a plurality of resistor groups connected in series between reference voltages;

a plurality of resistors which are connected in series to configure each of the resistor groups; and

a plurality of switching elements, each of the plurality of switching elements being connected with a connection node of corresponding one of the plurality of resistors,

20 wherein:

forming parts of the series-connected resistors of each resistor group are disposed within each different laser irradiation area;

all the forming parts of the resistors which are disposed within the laser irradiation area are crystallized with a same laser shot; and

25 auxiliary resistors are disposed so as to be connected in parallel with each resistor group; and

each of the auxiliary resistors has a same resistance value that is sufficiently smaller than a combined resistance value of the resistor group to which each auxiliary resistor is connected.

30 34. The D/A converter circuit according to claim 33, wherein each of the auxiliary

resistors is a thin film element crystallized by laser irradiation, all the forming parts of the auxiliary resistors are disposed within a laser irradiation area, and all the forming parts of the auxiliary resistors, which are disposed within the laser irradiation area, are crystallized with a same laser shot.

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35. The D/A converter circuit according to claim 33, wherein each forming part of the resistors is disposed to be parallel with each other, and also to be parallel to a scan direction of the linear laser irradiation.

10 36. The D/A converter circuit according to claim 33, wherein each forming part of the resistors has a same shape.

15 37. The D/A converter circuit according to claim 33, wherein each forming part of the resistors is connected with each other by a metal wiring having a same resistance value as those of the resistors.

38. A D/A converter circuit comprising:

a resistor string which includes a plurality of resistors connected in series between reference voltages; and

20 a plurality of switching elements, each of the plurality of switching elements being connected with a connection node of corresponding one of the plurality of resistors,

wherein:

each of the resistors is a thin film element crystallized by linear laser irradiation;

25 all forming parts of the resistors configuring the resistor string are disposed within a laser irradiation area; and

all the forming parts of the resistors which are disposed within the laser irradiation area are irradiated with one laser shot.

30 39. The D/A converter circuit according to claim 38, wherein each forming part of the resistors is disposed to be parallel with each other.

40. The D/A converter circuit according to claim 38, wherein each forming part of the resistors has a same shape.
- 5 41. The D/A converter circuit according to claim 38, wherein each forming part of the resistors is connected with each other by a metal wiring having a same resistance value as those of the resistors.
- 10 42. A D/A converter circuit comprising:
- a resistor string which includes a plurality of resistor groups connected in series between reference voltages;
- a plurality of resistors which are connected in series to configure each of the resistor groups; and
- a plurality of switching elements, each of the plurality of switching elements being connected with a connection node of corresponding one of the plurality of resistors,
- 15 wherein:
- each of the resistors is a thin film element crystallized by linear laser irradiation;
- forming parts of the series-connected resistors of each resistor group are disposed within each different laser irradiation area;
- 20 all the forming parts of the resistors which are disposed within the laser irradiation area are crystallized with one laser shot;
- auxiliary resistors are disposed so as to be connected in parallel with each resistor group;
- and
- each of the auxiliary resistors has a same resistance value that is sufficiently smaller than
- 25 a combined resistance value of the resistor group to which each auxiliary resistor is connected.
43. The D/A converter circuit according to claim 42, wherein:
- each of the auxiliary resistors is a thin film element crystallized by laser irradiation; all the forming parts of the resistors are disposed within the laser irradiation area; and all the
- 30 forming parts which are disposed within the laser irradiation area are crystallized with one laser

shot.

44. The D/A converter circuit according to claim 42, wherein each forming part of the resistors is disposed to be parallel with each other.

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45. The D/A converter circuit according to claim 42, wherein each forming part of the resistors has a same shape.

10 46. The D/A converter circuit according to claim 42, wherein each forming part of the resistors is connected with each other by a metal wiring having a same resistance value as those of the resistors.

15 47. A semiconductor device incorporating a D/A converter circuit, comprising:
 a resistor string which includes a plurality of resistors connected in series between reference voltages; and
 a plurality of switching elements, each of the plurality of switching elements being connected with a connection node of corresponding one of the plurality of resistors,
 wherein:
 each of the resistors is a thin film element crystallized by linear laser irradiation;
 all forming parts of the resistors configuring the resistor string are disposed within a laser irradiation area; and
 all the forming parts of the resistors which are disposed within the laser irradiation area are crystallized with a same laser shot.

20 48. The semiconductor device incorporating a D/A converter circuit according to claim 47, wherein each forming part of the resistors is disposed to be parallel with each other, and also to be parallel with a scan direction of the linear laser irradiation.

25 49. The semiconductor device incorporating a D/A converter circuit according to claim 47, wherein each forming part of the resistors has a same shape.

50. The semiconductor device incorporating a D/A converter circuit according to claim 47, wherein each forming part of the resistors is connected with each other by a metal wiring having a same resistance value as those of the resistors.

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51. A semiconductor device incorporating a D/A converter circuit, comprising:
a resistor string which includes a plurality of resistor groups connected in series between reference voltages;
a plurality of resistors which are connected in series to configure each of the resistor groups; and

a plurality of switching elements, each of the plurality of switching elements being connected with a connection node of corresponding one of the plurality of resistors,
wherein:

each of the resistors is a thin film element crystallized by linear laser irradiation;
15 forming parts of the series-connected resistors of each resistor group are disposed within each different laser irradiation area;
all the forming parts of the resistors which are disposed within the laser irradiation area are crystallized with one laser shot;

auxiliary resistors are disposed so as to be connected in parallel with each resistor group;
20 and

each of the auxiliary resistors has a same resistance value that is sufficiently smaller than a combined resistance value of the resistor group to which each auxiliary resistor is connected.

52. The semiconductor device incorporating a D/A converter circuit according to claim 25 51, wherein:

each of the auxiliary resistors is a thin film element crystallized by laser irradiation;
all forming parts of the auxiliary resistors are disposed within a laser irradiation area; and
all the forming parts of the auxiliary resistors which are disposed within the laser irradiation area are crystallized with a same laser shot.

53. The semiconductor device incorporating a D/A converter circuit according to claim 51, wherein each forming part of the resistors is disposed to be parallel with each other, and also to be parallel with a scan direction of the linear laser irradiation.
- 5 54. The semiconductor device incorporating a D/A converter circuit according to claim 51, wherein each forming part of the resistors has a same shape.
- 10 55. The semiconductor device incorporating a D/A converter circuit according to claim 51, wherein each forming part of the resistors is connected with each other by a metal wiring having a same resistance value as those of the resistors.
- 15 56. A semiconductor device incorporating a D/A converter circuit, comprising:
a resistor string which includes a plurality of resistors connected in series between reference voltages; and
a plurality of switching elements, each of the plurality of switching elements being connected with a connection node of corresponding one of the plurality of resistors,
wherein:
each of the resistors is a thin film element crystallized by linear laser irradiation;
all forming parts of the resistors configuring the resistor string are disposed within a laser 20 irradiation area; and
all the forming parts of the resistors which are disposed within the laser irradiation area are crystallized with one laser shot.
- 25 57. The semiconductor device incorporating a D/A converter circuit according to claim 56, wherein each forming part of the resistors is parallel with each other.
58. The semiconductor device incorporating a D/A converter circuit according to claim 56, wherein each forming part of the resistors has a same shape.
- 30 59. The semiconductor device incorporating a D/A converter circuit according to claim

56, wherein each forming part of the resistors is connected with each other by a metal wiring having a same resistance value as those of the resistors.

60. A semiconductor device incorporating a D/A converter circuit, comprising:

- 5 a resistor string which includes a plurality of resistor groups connected in series between reference voltages;
- a plurality of resistors which are connected in series to configure each of the resistor groups; and
- a plurality of switching elements, each of the plurality of switching elements being connected with a connection node of corresponding one of the plurality of resistors,
- 10 wherein:
 - each of the resistors is a thin film element crystallized by laser irradiation;
 - forming parts of the series-connected resistors of each resistor group are disposed within each different laser irradiation area;
- 15 all the forming parts of the resistors which are disposed within the laser irradiation area are crystallized with one laser shot;
- auxiliary resistors are disposed so as to be connected in parallel with each resistor group;
- and
- each of the auxiliary resistors has a same resistance value that is sufficiently smaller than
- 20 a combined resistance value of the resistor group to which each auxiliary resistor is connected.

61. The semiconductor device incorporating a D/A converter circuit according to claim 60, wherein:

- each of the auxiliary resistors is a thin film element crystallized by laser irradiation;
- 25 all forming parts of the auxiliary resistors are disposed within a laser irradiation area; and
- all the forming parts of the auxiliary resistors which are disposed within the laser irradiation area are crystallized with one laser shot.

62. The semiconductor device incorporating a D/A converter circuit according to claim 60, wherein each forming part of the resistors is parallel with each other.

63. The semiconductor device incorporating a D/A converter circuit according to claim 60, wherein each forming part of the resistors has a same shape.

5 64. The semiconductor device incorporating a D/A converter circuit according to claim 60, wherein each forming part of the resistors is connected with each other by a metal wiring having a same resistance value as those of the resistors.

10 65. A D/A converter circuit comprising:

a substrate;
a plurality of resistors including polysilicon formed over the substrate;
a plurality of wirings electrically connecting the plurality of resistors in series; and
a plurality of switching elements, each of which is electrically connected to corresponding one of the plurality of wirings,

15 wherein:
each carrier flow direction of the plurality of resistors are different from a direction the plurality of resistors are arranged.

20 66. A D/A converter circuit comprising:

a substrate;
a plurality of resistor groups, each of the plurality of resistor groups including:
a plurality of first resistors including polysilicon formed over the substrate;
a plurality of wirings electrically connecting the plurality of first resistors in series;
and
a plurality of switching elements, each of which is electrically connected to corresponding one of the plurality of wirings; and
a plurality of second resistors electrically connected in series with each other, and in parallel with corresponding one of the plurality of resistor groups,
wherein:
each carrier flow direction of the plurality of first resistors are different from a direction

the plurality of resistors are arranged.

67. A D/A converter circuit according to Claim 66, wherein the plurality of second resistors comprising polysilicon formed over the substrate.

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68. A D/A converter circuit according to Claim 66, wherein each carrier flow direction of the plurality of second resistors are different from a direction the plurality of resistors are arranged.

10 69. An electronic apparatus incorporating the semiconductor device of any one of claims 1 to 68.